

RESEARCH ARTICLE

Association between state Medicaid expansion status and health outcomes during the COVID-19 pandemic

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[Correction added on 9 September 2022, after
first online publication: in the Principal
Findings section of the Abstract, '0.049
percentage' has been changed to '4.9
percentage' in this version.]

Abstract

Objective: To assess post-COVID-19 changes in insurance coverage, health behaviors, and self-assessed health among low-income, non-elderly adults by state Medicaid expansion status.

Data Sources: We used nationally representative survey data from the 2016 through 2020 Behavioral Risk Factor Surveillance System (BRFSS). The sample was restricted to adults aged 19–64 with household income below 138 percent of the federal poverty level ($N = 179,135$).

Study Design: We examined a broad set of outcomes related to coverage, health behaviors, and self-assessed health available in the BRFSS. We used a difference-in-differences model to compare changes in outcomes for individuals living in the 35 states and DC that expanded Medicaid under the Affordable Care Act to those in the 15 non-expansion states before and after the COVID-19 pandemic commenced in March 2020.

Data Collection/Extraction Methods: N/A.

Principal Findings: We found that the expansions provided some protection for low-income people during the pandemic. In 2020, relative to earlier years, people in expansion states were more likely to report very good or excellent health (4.9 percentage points, 95%CI = 0.022, 0.076; $p < 0.01$) and physical health (−0.393 days of poor physical health in the past month, 95%CI = −0.714, −0.072; $p < 0.05$), lower rates of smoking (−1.9 percentage points, 95%CI = −0.041, 0.004; $p < 0.10$) and heavy drinking (−1.4 percentage points, 95%CI = −0.025, −0.004; $p < 0.01$), and higher flu vaccination rates (2.8 percentage points, 95%CI = 0.005, 0.051; $p < 0.05$) than those in non-expansion states. These benefits were particularly salient for Black and Hispanic individuals. We found no significant differences in insurance coverage, exercise, obesity, and self-assessed mental health between expansion and non-expansion states for the overall low-income sample. However, the expansion was associated with greater insurance coverage for Hispanic adults during the pandemic.

Conclusions: Investments in public health through expanding Medicaid may shield low-income populations from some of the health ramifications of public health emergencies.

KEYWORDS

affordable care act, COVID-19, health behaviors, Medicaid

What is known on this topic

- Before the COVID-19 pandemic, the Affordable Care Act-facilitated Medicaid expansions increased insurance coverage, reduced barriers to care, increased engagement in some healthy behaviors, and improved self-assessed health for low-income adults.
- Recent studies found no detectable effect of Medicaid expansions on COVID-19 caseloads or death rates, drug overdose deaths, insurance coverage, or access to care during the COVID-19 pandemic.
- However, for a subsample of low-income Black and Latinx people, Medicaid expansion was associated with protection against a rise in uninsurance.

What this study adds

- This study is the first to use nationally representative data to empirically assess the correlation between Medicaid expansion and changes in health outcomes and risky behaviors during the pandemic.
- In 2020, relative to earlier years, low-income adults in expansion states had better self-assessed health, lower rates of smoking and drinking, and higher flu vaccination than those in non-expansion states.
- Medicaid expansion had some protective effects for low-income adults during the first year of the pandemic.

1 | INTRODUCTION

As the COVID-19 pandemic unfolded, there was widespread concern that the nearly 30 million uninsured Americans would be disproportionately affected.^{1,2} Many uninsured individuals have low incomes and delay or avoid seeking care because of cost; in the case of COVID-19, postponing care can lead to severe illness.³ Moreover, uninsured people have worse mental health outcomes⁴ and are more likely to be essential workers,¹ which may contribute to higher psychological distress during the pandemic. Additionally, during the onset of the pandemic, people exhibiting symptoms were discouraged from going to the emergency room (ER) and told to schedule a telehealth visit with their primary care physicians (PCPs). This left few options for uninsured people, who often do not have PCPs and have historically relied on ERs for routine, non-emergent care.⁵ Finally, the uninsured are more likely to have unmanaged chronic diseases, such as heart disease and diabetes.⁶ It is well-documented that the coronavirus is more likely to cause severe illness or death in patients with worse baseline health,⁷ which puts the uninsured at higher risk.

A plethora of studies have documented numerous health benefits of the Affordable Care Act (ACA)-facilitated Medicaid expansions for low-income adults before the COVID-19 pandemic, including increased health insurance coverage,⁸ reduced cost barriers to care,³ increased preventive care utilization, improved health behaviors,⁹ and improved self-assessed health.¹⁰ When the pandemic struck, researchers and policy makers hypothesized that Medicaid would play an essential role in protecting low-income people.^{2,11-14} However, when these hypotheses were published, data were not available for empirical verification. The current study fills that gap.

There are several reasons to expect insurance rates in expansion and non-expansion states to diverge after the onset of the pandemic.

First, while the pandemic and its associated recession caused widespread job loss, we would expect less reduction in coverage in Medicaid expansion states, where workers who lost income during the pandemic became eligible for Medicaid at higher income thresholds. Indeed, early reports suggest that Medicaid enrollment increased by millions as the pandemic rolled out and those expansion-eligible populations drove these increases.^{15,16} Moreover, Medicaid expansion states were better positioned to take advantage of some of the federal policy changes facilitating continuity of coverage. For example, the Families First Coronavirus Response Act (FFCRA) mandated continuous coverage and prohibited states from disenrolling Medicaid beneficiaries during public health emergencies. Compared to non-expansion states, a larger portion of low-income adults was already covered by Medicaid in expansion states and thus experienced protection under the FFCRA.

We would also expect higher pre-pandemic insurance rates to translate to improved post-pandemic health behaviors because of years of increased interactions with health care providers and receiving helpful information from PCPs' offices. For example, insured individuals likely received information from their providers on the additional risks the virus poses for smokers and consequently may have been more motivated to reduce smoking when the pandemic struck. Medicaid expansion may have also softened the impact of the COVID-associated recession for low-income people by having improved their financial outcomes in the years before the pandemic,^{17,18} leading to increased financial security and money to invest in healthy behaviors during the pandemic.

Finally, we would expect better health outcomes in expansion states because low-income people in these states had higher pre-pandemic insurance rates and thus were more likely to already be well-connected with PCPs when the pandemic struck. Government

guidelines for those developing symptoms were to stay home, seek advice from their PCPs via telephone, and avoid going to the ER unless symptoms become severe. Those in expansion states who already had established connections with PCPs were better equipped to follow this advice, receive health-promoting information from PCPs over the phone (e.g., the importance of wearing masks and social distancing), reduce unnecessary exposure in emergency rooms, and thus protect their health during the pandemic. Additionally, the coronavirus was more likely to cause serious illness and death in patients with pre-existing medical conditions. To the extent to which low-income adults in expansion states had higher baseline levels of health due to years of insurance coverage pre-pandemic,⁴ they may have been less likely than those in non-expansion states to develop the severe disease during the pandemic.

This study provides some of the first evidence of the persisting protections of Medicaid expansion on low-income people's health during the first year of the COVID-19 pandemic. We used nationally representative survey data and a quasi-experimental research design to estimate changes in low-income, non-elderly adults' health behaviors and self-assessed health outcomes by state Medicaid expansion status during the pandemic (March to December 2020) compared with years before the pandemic (January 2016 to February 2020). Earlier research has examined differences in COVID-19 death rates,¹⁹ disparities in uninsurance and access to care,²⁰ and drug and opioid deaths²¹ in expansion versus non-expansion states during the pandemic. These previous studies found only modest impacts of Medicaid expansion. Chakrabarti et al. (2020) found no detectable effect of Medicaid expansion on COVID-19 caseloads or death rates at the county level; however, the authors note that people in expansion states were more likely to see a doctor for COVID-19 symptoms, which suggests that Medicaid may have reduced true cases and deaths but increased the reporting rate for infected individuals, making the overall effect appear to be zero.¹⁹ Figueroa et al. (2021) examined health outcomes among low-income individuals in four Southern states and found that insurance coverage and access to care worsened in all four states during the pandemic, with no significant difference by expansion status. However, for the subsample of low-income Black and Latinx people, expansion was associated with protection against a rise in uninsurance.²⁰ Auty and Griffith (2022) found that drug overdose deaths increased in 2020 for both expansion and non-expansion states, with no significant correlation between expansion status and overdose deaths.²¹

We build on this earlier work by examining a broader set of outcomes— including insurance coverage, health behaviors, and self-assessed health—and using nationally representative survey data covering all 50 states and DC. To our knowledge, this study is the first empirical analysis of the correlation between Medicaid expansion and risky behaviors and health outcomes during the pandemic. Our findings suggest that Medicaid expansion had some protective effect on low-income adults during the first year of the pandemic. In 2020, relative to earlier years, those who lived in Medicaid expansion states had better self-assessed general health, lower rates of smoking and heavy drinking, and higher flu vaccination rates than those in non-expansion

states. Like Figueroa et al., we found no significant differences in insurance coverage between expansion and non-expansion states, nor were there significant differences in exercise, obesity, or self-assessed mental health.

2 | METHODS

2.1 | Data and sample

Our primary data source was the Behavioral Risk Factor Surveillance System (BRFSS), an annual telephone survey conducted by the Centers for Disease Control and Prevention (CDC). The survey is conducted every month in all 50 states and DC and is representative of the US non-institutional population. The total sample size is approximately 500,000 individuals per year. For our main analysis, we used 2016 through 2020 BRFSS data and restricted our sample to adults aged 19–64 with household income below 138 percent of the federal poverty level (i.e., the target population of Medicaid expansion). We used post-2016 data because most states that participated in the ACA Medicaid expansion had implemented their expansions by then.²² Our total study sample was 179,135 individuals across five years.

A potential concern about using the BRFSS to assess post-COVID changes in outcomes may be if the pandemic circumstances disrupted data collection in a way that biases response rates. The CDC addresses this question in a document titled “Behavioral Risk Analysis Factor Surveillance System: Comparability of Data BRFSS 2020.” The document suggests that, for the most part, data collected from 2020 is comparable to previous years. While data collection was interrupted during the initial months of the pandemic, most states made up for these shortfalls by the end of the data collection year. We note, however, that the months of data collection missed in some states may affect seasonal estimates, for example, a flu vaccination. In the section below, we describe sensitivity analyses to address this concern.

We examined a broad set of outcomes related to health behaviors, insurance coverage, and self-assessed health. The primary outcome variables were: (1) an indicator for having any health insurance coverage; indicators for whether the respondent (2) engaged in heavy drinking (defined as averaging two drinks per day for men and one drink per day for women) in the past month, (3) smoked in the past month, (4) exercised in the past month, (5) was obese, and (6) had a flu vaccine in the past year; (7) the respondent's self-reported health (very good or excellent general health); the number of days in the past month the respondent reported (8) poor physical health and (9) poor mental health; and (10) the number of days in the past months the respondent's poor health prevented usual activities.

2.2 | Analytic strategy

We used a difference-in-differences (DD) model to assess whether state Medicaid expansion mitigated the effect of the pandemic and its

associated recession in post-COVID months (March through December 2020) compared with pre-COVID months (January 2016 through February 2020). We compared changes in outcomes for individuals living in the 35 states and DC that expanded Medicaid under the ACA before July 2020 ($N = 119,676$) to those in the 15 non-expansion states ($N = 59,459$). This method is similar to that used by Figueroa et al. (2021), who examined insurance coverage and access to care by expansion status before and during the pandemic in four US states.²⁰ This method is also similar to Auty and Griffith (2022), who compared annual drug-related death rates among all US states by expansion status before and during the pandemic in 2020.²¹ Table S1 lists the states in our analysis by expansion status.

Our main coefficient of interest was the interaction between the Medicaid expansion status of respondents' residential state and an indicator for interviews conducted in post-COVID months (March through December 2020). We controlled for respondents' demographic characteristics (age, race and ethnicity, educational attainment, employment status, sex, marital status, parental status, household size, and whether the respondent was part of BRFSS's cell phone sample), state unemployment rate, state of residence, and quarter-year of interview. All analyses included BRFSS survey weights, and robust standard errors were clustered at the state level. We estimated these models for the aggregate low-income, non-elderly sample, as well as stratified by respondents' race and ethnicity, sex, educational attainment, gender, age, parental status, and pandemic severity in their state of residence.

A key identifying assumption of our DD model is that in the absence of the pandemic, expansion and non-expansion states would have trended similarly in 2020. Although it is impossible to confirm this, we provide suggestive evidence by examining whether expansion and non-expansion states followed common trends in the pre-2020 period. Specifically, we estimated a regression model comparing changes in outcomes between expansion and non-expansion states from 2016 to 2019, controlling for the same variables described above in our main model.

We conducted several supplementary analyses to assess whether our results were robust to alternate specifications of the model—including adding more years of pre-pandemic data, dropping one year at a time of pre-pandemic data, using higher income levels to define our low-income sample, identifying our sample based on educational attainment rather than income, dropping respondents interviewed in March 2020 since it is not immediately clear whether March 2020 should be included in the pre- or post-pandemic period, dropping states that expanded Medicaid in 2020 (Idaho and Utah) since people in these states may not have had sufficient time to enroll before the pandemic, and dropping the individual- and state-level demographic controls from our model. As noted in the “Data and Sample” section above, the shelter-in-place policies interrupted data collection in most states. Though states were able to make up for these shortfalls by the end of the collection year, the months of missed data collection may affect seasonal estimates, such as flu vaccination. To address whether this seasonality issue biased our results, we

estimated a set of regressions excluding January and February of all years.

Another fundamental assumption of the DD model is that expansion and non-expansion states did not undergo other differential changes at the same that the pandemic began. For example, if Democrat-led states were more likely to be expansion states and also implemented mask mandates in response to the pandemic, then it would be unclear whether our DD results reflect the implementation of Medicaid expansion or stricter COVID-19 response policies. To address this concern, we estimated sensitivity analyses in which we controlled for states' implementation of mask mandates as a measure of the strictness of their COVID-19 response policies. Another potential confounder may exist if Medicaid expansion states experienced greater COVID-19 caseloads due to higher population density, international travel, etc.; this would bias our results toward zero. Although an existing study found little correlation between Medicaid expansion status and COVID-19 severity,¹⁹ we provide suggestive evidence by conducting a heterogeneity test in which we estimate our regressions separately for states with higher-than-average versus lower-than-average COVID-19 case rates. Table S1 presents our classification of states' mask mandate policies and COVID-19 severity.

Finally, we explored the possibility of multiple hypothesis bias by using the Seemingly Unrelated Regression (SUR) method used in previous studies.^{4,23} This method uses F-tests to evaluate the compound null hypothesis that all coefficients within a given category of outcomes are jointly equal to 0.

3 | RESULTS

Table 1 presents descriptive statistics of our study sample, stratified by Medicaid expansion status. The states' populations differed significantly by most demographic characteristics. However, these differences tend to be small in magnitude, and we controlled for these variables in our regression analysis.

Next, we present our main DD regression results. Table 2 displays regression-adjusted changes in insurance coverage, health behaviors, and self-assessed health associated with living in a Medicaid expansion state during the COVID-19 pandemic. Compared to those in non-expansion states, individuals in expansion states were less likely to engage in heavy drinking (−1.4 percentage points, 95% CI = −0.025, −0.004; $p < 0.01$) and smoking (−1.9 percentage points, 95%CI = −0.041, 0.004; $p < 0.10$), and more likely to receive a flu shot (2.8 percentage points, 95%CI = 0.005, 0.051; $p < 0.05$) in 2020 relative to earlier years. All three findings represent an improvement in health behaviors. Across self-assessed health outcomes, people in expansion states were more likely to report very good or excellent health (4.9 percentage points, 95%CI = 0.022, 0.076; $p < 0.01$) and fewer days of poor physical health in the past month (−0.393 days, 95%CI = −0.714, −0.072; $p < 0.05$). There was no statistically significant difference in insurance coverage, exercise, obesity, and self-assessed mental health between individuals in expansion and

TABLE 1 Descriptive statistics of study sample

	Expansion states		Non-expansion states		Difference
	Mean	SD	Mean	SD	
Age	39.039	13.261	39.547	13.175	-0.507***
Race and ethnicity					
White, non-Hispanic	0.381	0.486	0.376	0.484	0.005**
Black, non-Hispanic	0.154	0.361	0.243	0.429	-0.088***
Other, non-Hispanic	0.101	0.301	0.053	0.224	0.047***
Hispanic	0.364	0.481	0.328	0.470	0.036***
Educational attainment					
Less than high school	0.328	0.469	0.321	0.467	0.007***
High school	0.339	0.473	0.353	0.478	-0.013***
Some college	0.259	0.438	0.259	0.438	-0.000
College or more	0.074	0.262	0.067	0.250	0.007***
Unemployed	0.154	0.361	0.146	0.353	0.009***
Female	0.590	0.492	0.617	0.486	-0.027***
Married	0.282	0.450	0.299	0.458	-0.016***
Number of children	1.434	1.701	1.484	1.567	-0.050***
Household size	2.746	1.886	2.747	1.699	-0.001
Cell phone sample	0.869	0.337	0.907	0.290	-0.038***
State unemployment rate	5.022	2.357	4.561	1.828	0.461***
Observations	119,676		59,459		

Note: Sample includes respondents aged 19–64 with household incomes below 138% of the federal poverty level ($N = 179,135$). Estimates account for BRFSS survey weights. *** $p < 0.01$,

** $p < 0.05$, * $p < 0.10$.

Source: Authors' calculations based on Behavioral Risk Factor Surveillance System (BRFSS) 2016–2020.

non-expansion states during the COVID-19 pandemic relative to earlier years. Although the estimates for these outcomes were imprecisely estimated, they were mostly in the expected direction. For example, individuals in expansion states were more likely to report having health insurance (statistically insignificant coefficient of 1.3 percentage points). Table S2 presents full regression results.

We assessed whether outcomes in expansion and non-expansion states followed common trends in the pre-2020 period—this is a key identifying assumption of our DD model. In Table S3, we present pre-trends tests comparing changes in outcomes between expansion and non-expansion states from 2016 to 2019. None of the outcome variables differed significantly by expansion status before the pandemic, which increases our confidence in the validity of our DD model.

3.1 | Heterogeneity tests

Next, we conducted heterogeneity tests to explore whether the benefits of Medicaid expansion differed for subgroups. We began by estimating our regression models separately by race and ethnicity. Table 3 shows that Medicaid expansion was associated with significant increases in the probability of being insured post-COVID among Hispanic adults (4.3 percentage points, 95%CI = 0.002, 0.084; $p < 0.05$) and among non-Hispanic, other race adults (5.4 percentage

points, 95%CI = 0.000, 0.108; $p < 0.05$). Table 3 also suggests that the post-COVID reductions in smoking and heavy drinking were driven by Black and Hispanic adults, respectively. We found large improvements in self-assessed general health among Hispanic individuals (8 percentage points, 95%CI = 0.026, 0.134; $p < 0.01$). Notably, we estimated a reduction in the number of days of poor mental health among Black individuals.

Table S4 presents additional heterogeneity tests by state COVID severity, sex, educational attainment, age group, and parental status. The largest differences in health behaviors were observed by sex and by parental status. Men in Medicaid expansion states post-COVID were less likely to engage in heavy drinking and smoking and more likely to receive a flu shot; effect sizes were considerably smaller and statistically insignificant for women. When we examined respondents separately by parental status, we found that nearly all the improvements in health behaviors and self-assessed health observed in Medicaid expansion states were driven by parents. Although this result may seem counterintuitive, as the ACA-facilitated Medicaid expansions primarily targeted childless adults, it is in line with previous studies that found large “welcome mat” effects of the expansion for parents.^{24–26}

We found little difference in our key findings by state COVID severity. The improvements we observed in general health were mainly driven by those with less than a college degree; we note,

TABLE 2 Regression results for the effect of medicaid expansion on health outcomes during COVID

	Expansion states		Non-expansion states		DD estimate (5)	Percent change (6)
	Pre-pandemic mean (1)	Post-pandemic mean (2)	Pre-pandemic mean (3)	Post-pandemic mean (4)		
Have insurance	0.775	0.776	0.598	0.575	0.013 [-0.019, 0.045]	-
Health behaviors						
Heavy drinking	0.052	0.053	0.055	0.068	-0.014*** [-0.025, -0.004]	-26.9%
Current smoker	0.270	0.269	0.294	0.282	-0.019* [-0.041, 0.004]	-7.0%
Flu shot	0.298	0.320	0.270	0.260	0.028** [0.005, 0.051]	9.4%
Exercise	0.649	0.649	0.609	0.609	0.016 [-0.010, 0.042]	-
Obese	0.362	0.380	0.402	0.452	-0.025 [-0.060, 0.011]	-
Self-assessed health						
General health is very good or excellent	0.317	0.410	0.302	0.366	0.049*** [0.022, 0.076]	15.5%
Days of poor mental health	6.809	7.174	7.121	7.240	-0.321 [-0.785, 0.143]	-
Days of poor physical health	6.321	4.979	6.680	5.351	-0.393** [-0.714, -0.072]	-6.2%
Days poor health prevented usual activities	7.999	7.962	8.513	8.344	-0.283 [-1.049, 0.484]	-

Note: Each row represents a different regression. Sample includes respondents aged 19–64 with household incomes below 138% of the federal poverty level (N = 179,135). Columns (1) through (4) present raw means for expansion and non-expansion states, separately for pre-pandemic periods and post-pandemic periods. Column (5) presents difference-in-differences (DD) coefficient estimates for the interaction of the Medicaid expansion indicator and post-March 2020 indicator. 95% confidence intervals are in parentheses. Regressions control for respondents' demographic characteristics (including age, race and ethnicity, educational attainment, employment status, sex, marital status, parental status, household size, and whether the respondent was part of BRFSS's cell phone sample), state unemployment rate, state of residence, and quarter-year of interview. Estimates account for BRFSS survey weights, and standard errors are clustered by state. Column (6) displays the DD estimate divided by the pre-pandemic mean for expansion states, for outcomes with statistically significant effects. ***p < 0.01, **p < 0.05, *p < 0.10.

Source: Authors' calculations based on Behavioral Risk Factor Surveillance System (BRFSS) 2016–2020.

however, that there was a reduction in the number of days of poor mental health for low-income people with a college degree or more. In terms of age-based differences, the increases in flu vaccination were driven by those below age 50.

3.2 | Sensitivity analyses

Table S5 shows that our results are robust to the use of alternate study periods. Whether we expanded our study period to 2014–20 or restricted our study period to 2019–20, our coefficients were stable in terms of magnitude and statistical significance. This provides reassuring evidence that our key results were indeed driven by post-COVID changes and not our choice of the pre-COVID study period.

To account for the possibility that the pandemic-associated recession shifted the composition of our low-income sample in 2020, we explored alternative ways of identifying our study sample. In Table S6,

we show that if we expanded our sample to include those with incomes less than 150% federal poverty level (FPL), less than 200% FPL, or less than 250% FPL, our substantive results were very similar. When we classified our sample as non-elderly adults with high school or less educational attainment, we continued to find improvements in health behaviors but no longer found statistically significant results for self-assessed health. This may be because education is weakly correlated with income in the BRFSS.⁴ As a whole, the results from the sensitivity analyses presented in Table S6 lessen concerns regarding changing sample composition.

Table S6 shows that, as a whole, our baseline results are robust to several alternate model specifications. In the three models in which we dropped 2020 expansion states from analysis, dropped control variables, and controlled for state mask mandates, the coefficients were nearly identical to our baseline results, both in magnitude and statistical significance. When we dropped March 2020 from the analysis, we continued to find reductions in heavy drinking and increases in

TABLE 3 Regression results by race and ethnicity

	White, non-Hispanic	Black, non-Hispanic	Other, non-Hispanic	Hispanic
Have Insurance	-0.023* [-0.048, 0.003] μ = 0.871	0.027 [-0.007, 0.060] μ = 0.843	0.054** [0.000, 0.108] μ = 0.851	0.043** [0.002, 0.084] μ = 0.627
Health behaviors				
Heavy drinking	-0.000 [-0.018, 0.017] μ = 0.065	-0.024 [-0.055, 0.006] μ = 0.054	-0.002 [-0.047, 0.043] μ = 0.045	-0.027*** [-0.047, -0.007] μ = 0.039
Current smoker	-0.017 [-0.060, 0.026] μ = 0.395	-0.060*** [-0.101, -0.019] μ = 0.305	-0.028 [-0.080, 0.024] μ = 0.231	-0.014 [-0.035, 0.006] μ = 0.136
Flu shot	0.031* [-0.001, 0.062] μ = 0.288	-0.017 [-0.061, 0.028] μ = 0.292	-0.019 [-0.104, 0.066] μ = 0.345	0.054*** [0.016, 0.092] μ = 0.298
Exercise	-0.013 [-0.051, 0.025] μ = 0.657	0.039 [-0.017, 0.096] μ = 0.621	-0.030 [-0.117, 0.057] μ = 0.704	0.033 [-0.038, 0.103] μ = 0.636
Obese	-0.051*** [-0.082, -0.020] μ = 0.361	0.004 [-0.084, 0.092] μ = 0.426	-0.006 [-0.105, 0.092] μ = 0.259	-0.021 [-0.102, 0.059] μ = 0.365
Self-assessed health				
General health is very good or excellent	0.035** [0.007, 0.064] μ = 0.330	0.060 [-0.017, 0.136] μ = 0.352	-0.024 [-0.151, 0.103] μ = 0.371	0.080*** [0.026, 0.134] μ = 0.276
Days of poor mental health	0.124 [-0.656, 0.903] μ = 9.294	-1.183** [-2.320, -0.046] μ = 6.903	0.403 [-1.797, 2.603] μ = 6.087	-0.427 [-1.174, 0.321] μ = 4.339
Days of poor physical health	0.194 [-0.656, 1.044] μ = 8.281	-1.903*** [-2.927, -0.880] μ = 6.181	-0.352 [-2.823, 2.119] μ = 5.544	-0.033 [-0.683, 0.618] μ = 4.488
Days poor health prevented usual activities	0.125 [-0.816, 1.066] μ = 9.406	-1.176* [-2.408, 0.057] μ = 8.038	1.257 [-1.002, 3.515] μ = 7.519	-0.668 [-2.015, 0.678] μ = 5.991

Note: Each row represents an outcome of interest. Each column contains the difference-in-differences (DD) estimates for the interaction of the Medicaid expansion indicator and post-March 2020 indicator, with 95% confidence intervals in parentheses. μ represents the pre-pandemic mean for expansion states. Regressions control for respondents' demographic characteristics (including age, educational attainment, employment status, sex, marital status, parental status, household size, and whether the respondent was part of the cell phone sample), state unemployment rate, state of residence, and quarter-year of interview. Estimates account for BRFSS survey weights, and standard errors are clustered by state. ***p < 0.01, **p < 0.05, *p < 0.10.
Source: Authors' calculations based on Behavioral Risk Factor Surveillance System (BRFSS) 2016–2020.

the probability of receiving flu shot. The coefficient sizes for our smoking and self-assessed health outcomes were similar to those from our baseline models but imprecisely estimated. Similarly, when we omitted January and February of all years, we continued to find reductions in heavy drinking, increases in flu vaccination, and increases in self-assessed general health. However, we no longer had statistically significant reductions in smoking.

Table S8 presents results from two falsification tests in which we estimated our models for two samples whose eligibility for public health insurance is unaffected by the ACA Medicaid expansions: the elderly and high-income individuals. These estimates were small and insignificant for nearly all outcomes, implying that Medicaid expansion did not play a role in post-pandemic outcomes for the elderly and high-income populations. These falsification tests support the validity of our main results.

When we had multiple measures in the same category of outcomes, we created an index variable that reflects all the measures in that category. In Table S9, we show that compared to those in non-expansion states, individuals in expansion states had a lower probability of engaging in *any* unhealthy behaviors (−1.6 percentage points, 95%CI = −0.028, −0.004; $p < 0.05$) and fewer total unhealthy days in the past month (−0.463 days, 95%CI = −0.853, −0.074; $p < 0.05$). This analysis provides confidence that we are not drawing conclusions about the entire category based on statistically significant estimates for only one or two outcomes.

Table S10 displays category-wise error rates for our SUR analysis. Stacking the data and using SUR estimation across outcomes, we reject the hypothesis that the ten coefficients are jointly equal to 0 ($p < 0.001$). We also reject the hypothesis that all the health behaviors outcomes ($p < 0.001$) and all the self-assessed health outcomes jointly equal 0 ($p = 0.009$). These results lessen some concerns about multiple hypothesis bias.

4 | DISCUSSION

During the COVID-19 pandemic, relative to earlier years, low-income adults in Medicaid expansion states had better self-assessed general and physical health, lower rates of smoking and heavy drinking, and higher flu vaccination rates than those in non-expansion states. While Medicaid expansion was associated with protective effects for some health behaviors and outcomes, it was not associated with differential changes in exercise, obesity, or self-assessed mental health for the overall low-income sample. Overall, our findings suggest a positive correlation between public health insurance availability and certain health outcomes during public health emergencies.

This study builds on earlier work by Figueroa et al. (2021), which found that among low-income adults in four Southern states, uninsured rates for Black and Latinx individuals increased less in expansion states (Arkansas, Kentucky, and Louisiana) than in non-expansion states (Texas).²⁰ The authors found that other measures of access to care, including having a personal physician and regular care for chronic conditions, worsened in all four states in 2020 with no significant

difference in Medicaid expansion status. Our findings supplement Figueroa et al.'s work by examining downstream outcomes related to self-assessed health and health behaviors in all 50 states and DC. Like Figueroa et al., we found no significant difference in insurance coverage by Medicaid expansion status for our overall study sample, though both Figueroa et al. and the current study found that Medicaid expansion was associated with greater post-pandemic insurance coverage among non-White groups. These results suggest the potential role that Medicaid expansion may have played in reducing racial and ethnic disparities in insurance coverage during the pandemic. Our study examined health behaviors and self-assessed health outcomes that Figueroa et al. did not study. We observed better health behaviors and self-assessed general and physical health among low-income individuals in expansion states, with particularly strong effects among Black and Hispanic individuals.

To our knowledge, this study is one of the first to use nationally-representative survey data to empirically assess the speculations^{2,11-14} that Medicaid expansion states are better positioned to handle the COVID-19 pandemic and associated recession. Assessing specific mechanisms through which Medicaid expansion shielded low-income people from some of the health ramifications of the pandemic is beyond the scope of this study. However, based on our robust findings of improved health behaviors, we hypothesize that the higher pre-pandemic insurance rates translated to reduced smoking and heavy drinking during the pandemic due to years of increased interactions with health care providers and receiving useful information on health-promoting behaviors from PCPs' offices. Given the substantial evidence that Medicaid expansion improved low-income people's financial outcomes in the years before the pandemic,^{17,18} it is also plausible that people in Medicaid expansion states started the pandemic with better baseline financial security and money to invest in their health when the pandemic struck. Finally, those in Medicaid expansion states also had higher baseline levels of health going into the pandemic,^{4,27} which may have provided some protection against serious illness and death.

There were some key changes to the Medicaid landscape at the onset of the pandemic (summarized in Table S11), and we hypothesize that expansion states were better positioned to take advantage of some of these changes because a larger portion of low-income adults was already covered by Medicaid in expansion states. So, for example, expansion states had more Medicaid beneficiaries who could benefit from the FFCRA, which mandated continuous coverage and prohibited states from disenrolling Medicaid beneficiaries during the public health emergency. Similarly, as states expanded the coverage of telehealth services by Medicaid, those that had already expanded Medicaid and had a large portion of their low-income population already enrolled in Medicaid were likely better equipped to connect beneficiaries with telehealth providers.

Our findings are relevant for ongoing policy discussions regarding the role of Medicaid during COVID-19. Expanding Medicaid in the remaining states would provide coverage to millions of older adults, people with underlying health conditions, and essential workers, all of whom are at higher risk of becoming infected or facing severe illness

if infected. There are 650,000 uninsured essential workers, and before the pandemic, the uninsured rate for these low-income workers was 30 percent in non-expansion states versus only 16 percent in expansion states.¹⁴ Expansion can also prevent the recession from widening racial and ethnic gaps in access to coverage and care, as the Great Recession did.¹⁴ Indeed, some policy makers have publicly acknowledged the importance of Medicaid in states' strategies to address COVID-19. For example, Louisiana's former secretary of health, Rebekah Gee, argued that Louisiana's 2016 expansion of Medicaid "... means that Louisiana has been positioned as one of the leaders in COVID-19 response."¹¹ While the pandemic has spurred some non-expansion states to consider Medicaid expansion,¹² there are several barriers to getting the expansions up and running, including the need for approval from the Centers for Medicare and Medicaid Services, system readiness to enroll large numbers of applicants, and expectations that state revenues will plummet because of the recession.¹²

Our analysis has several limitations. First, all outcomes were self-reported and subject to nonresponse and social desirability bias. Respondents may be less likely to participate in the survey in 2020 due to the pandemic circumstances. However, the 2020 BRFSS response rate of 48% was in line with previous years, which partially mitigates this concern. We also used survey weights to minimize non-response bias. Second, our quasi-experimental analysis is subject to potential time-varying confounders if states that expanded Medicaid implemented other policies or underwent other changes in 2020. For example, if states that expanded Medicaid also implemented other policies to address COVID-19 or the recession, then our results may incorrectly attribute differences in health outcomes to Medicaid. We partially addressed this issue by conducting a sensitivity analysis in which we control for states' policy response to the pandemic. Third, the BRFSS is a repeated cross-section, so it is impossible to observe the same individuals before and after the pandemic. It is possible that the pandemic-associated recession led to shifts in the composition of our low-income sample in 2020, though our sensitivity analyses using alternative ways to define our sample alleviates some of these concerns. Despite these limitations, the dataset's size and timely availability offer an opportunity to learn about the early effects of the Medicaid expansion on people's health outcomes during the pandemic.

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